Programmable Preselect Counter

GEL 104

User Manual

Lenord +Bauer

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1 Introduction

1.1 Fundamental safety instructions

▲ The programmable preselect counters type GEL 104 have been built in accordance with state-of-the-art standards and the recognised safety regulations. Nevertheless, its use may constitute a risk to life and limb of the user or of third parties, or cause damage to the counter or to other components property. The counters must only be used

– in accordance with their designated use

– in technically perfect condition.

In order to maintain this status and to ensure a safe operation of the counters, only **skilled personnel**[1] are allowed to commission, connect and service these components, while observing the current regulations for prevention of accidents and safety instructions as well as the operating instructions.

▲ If a break down or malfunctioning of the counter may cause injury or damage works equipment, this must be prevented by taking additional safety measures, such as, for example, installation of limit switches, protective devices, etc.

▲ If a **safe operation** can no longer be ensured, the counter must be stopped and secured against unintentional operation.

▲ When mounting and connecting, the counter and all other components concerned, must be **de-energised**: voltages up to **250 VAC** may occur! Make sure that meanwhile the line cannot be switched on.

▲ To ensure the hand contact safety (VDE 0106) of the connecting terminals a professional connection of the current-carrying cables is required. Terminals not being assigned ('NC') must not be wired-up.

▲ The counter must only be repaired by LENORD+BAUER or a company/person authorised by LENORD+BAUER.

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[1] Skilled personnel does mean:

– persons being familiar with the safety principles of automation systems,

– persons being trained on commissioning and servicing,

– persons knowing how to operate the device and knowing the relevant instructions in the manual which are vital for the proper functioning of the device.

1.2 Designated use

The GEL 104-type counters have been exclusively built for measuring and controlling purposes in industry. In conjunction with an incremental pulse generator, e.g. positions, lengths or angles may be measured and displayed or cutting and dosing jobs may be performed.

The counters should not be put into operation unless being **built in**.

Designated use also means that the user follows all instructions given in this manual.

Using the device for purposes other than those mentioned above is considered contrary to its designated use. LENORD, BAUER & CO. GMBH cannot be held liable for any damage resulting from such use.

1.3 Guarantee, liability and copyright

In principle, our general 'Terms of delivery and payment' apply which are part of the sales contract and are made available to the Buyer upon signing of the contract at the latest. LENORD, BAUER & CO. GMBH will not accept any **claim under guarantee nor any other responsibility** in case of injury to persons or damages, if they are due to one or several of the following reasons:

- non-designated use of the counter
- improper mounting, commissioning and operation of the counter
- operation of the counter when the safety devices of the line are defective or not operative
- non-observance of the instructions supplied in the manual regarding storage, assembly, commissioning and operation of the counter
- unauthorised modifications of the counter's design
- improper repair
- disasters caused by foreign objects and Force Majeure

This manual was prepared with utmost care. We do, however, not assume any liability with regard to faultlessness.

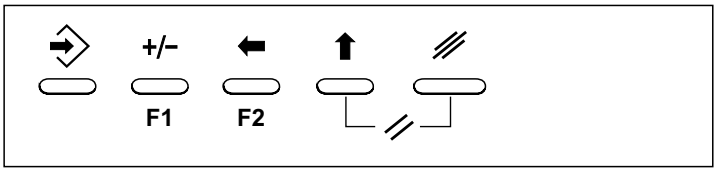
LENORD+BAUER hold the **copyright** of this operating manual. The manual is only intended for the buyer or the machine builder and their personnel. All instructions, notes and other data supplied must not be copied, distributed or communicated neither partially nor entirely.

Violations might be prosecuted.

2 Control elements

2.1 Keyboard

The function of these five keys depends on the current mode of operation of the counter.



1 store key

- in counting mode:
  in conjunction with another key only: start programming mode (see further below)
- in programming mode:
  save last entry and
  – terminate programming mode or
  – selection of subsequent parameter (depending on the programming plane)

2 sign key

- in counting mode:
  – programming of the 1st preset value P1 (**F1**)
  – together with the store key: programming the set value SET (➡ + **F1**)
- in programming mode:
  change sign (**+/–**)

3 cursor key 'left'

- in counting mode:
  – programming of the 2nd preset value P2 (**F2**)
  – together with the store key: programming of a prescaler PSC (prescaler) or decimal point (➡ + **F2**)
- in programming mode:
  activate next input position of a value (⬅)

4 cursor key 'up'

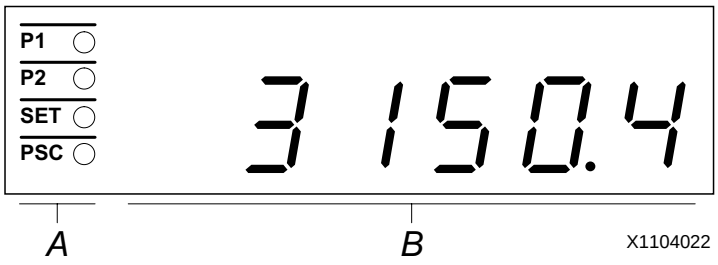
- when switching on:
  together with the store key: activate system programming mode
  (⇨ + ⬆)
- in counting mode:
  together with the delete key: reset = set count to set value and reset outputs (⬆ + ⫽ = ⫽)
- in programming mode:
  increment value at active input position (⬆)

5 delete key

- in counting mode:
  together with the cursor key 'up': reset, see above
  (⫽ + ⬆ = ⫽)
- in programming mode:
  delete current value, i.e. set to zero (⫽)

2.2 Display

The LED-type display consists of two areas:



A function indicators

- in counting mode:
  switching state of outputs *Out 1* (**P1**) and *Out 2* (**P2**)
- in programming mode:
  parameter active at present: preselection 1(**P1**), preselection 2 (**P2**), set value (**SET**), prescaler (**PSC**) or decimal point (–)

B value display

- in counting mode: current count of the counter
- in programming mode: parameter to be modified

3 Programming

Several programming planes are available for programming the counter.

Via the 1st programming plane the user is provided with access to the **operating parameters,** i.e. preselection 1 / 2 and set value, which are frequently changed.

In the second programming plane the **display parameters**, the prescaler and the decimal point can be set.

Access to the operating and display parameters can be locked by means of the control input *Keylock* (terminal 28).

In the third programming plane the general mode of operation of the counter and all plant or machine relevant **system parameters** will be fixed. Normally, this is only necessary on commissioning or after a retrofit.

3.1 Operating parameters

Enter this programming plane by a short pressing of a certain key or key combination (see below). The active parameter is indicated by flashing of the respective indicator (**P1**, **P2** or **SET**) and the lowest digit of the pertaining value.

To return to the counting mode either

– press the store key ➔◇ or

– it is carried out automatically approx. 15 seconds after actuation of a key (without saving a modified value).

Programming is performed as follows:

- if required, cancel a value using the delete key ⫽ (you may only erase an entire value, i.e. you may not erase it digit by digit)
- use the cursor key ⬅ to go to position of the value to be changed (the activated digit flashes)
- use the cursor key ⬆ to increment the figure concerned
- modify all remaining digits of the value as described above
- in case of a negative value press the operational sign key **+/−**
- save value by pressing the ➔◇ key

3.1.1 Preselections 1 (P1) and 2 (P2)

Key: **F1** for preselection 1 (P1)
F2 for preselection 2 (P2)

P1 may be interpreted either as absolute or relative value (see para. 3.3, system parameter F20).

P2 is the main preselection by means of which an automatic reset is initiated in the counter, provided that it had been programmed accordingly (see para. 3.3, system parameters F4).

As soon as the count reaches the programmed value of P1 or P2 (via counting pulses counted upwards or downwards), the respective relay switch *Out 1* or *Out 2* (*Out 1* is reset by P2).

3.1.2 Set value (SET)

Key: ➡ + **F1**

In case of a reset the count of the counter will be set to this value (via keyboard, terminal or automatically).

3.2 Display parameters

Key: ➡ + **F2**

The parameter last modified is the active one: prescaler (prescaler, indicator **PSC**) or decimal point. By briefly pressing the store key ➡ you may switch back and forth between the two parameters.

To return to the counting mode either

- press the store key ➡ longer than 2 seconds or
- it is performed automatically approx. 15 seconds after having last actuated any key (modified parameters will not be saved)

A reset is always performed.

3.2.1 Prescaler (PSC)

Values must be entered as described in para. 3.1.

By means of the prescaler the number of counting pulses (= encoder pulses ∗ edge evaluation) may be converted in such a way, that the count will be displayed in the required unit. A residual value processing is not performed.

Setting range: 0.0005 … 99.9999 (standard setting: 1.0000)

If you enter a value less than 0.0005 the error message *Error0* will be emitted. To enter a new value press the store key.

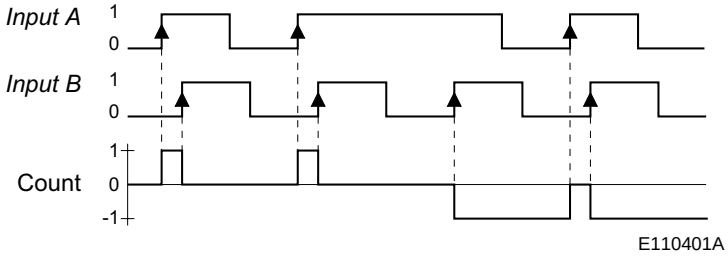
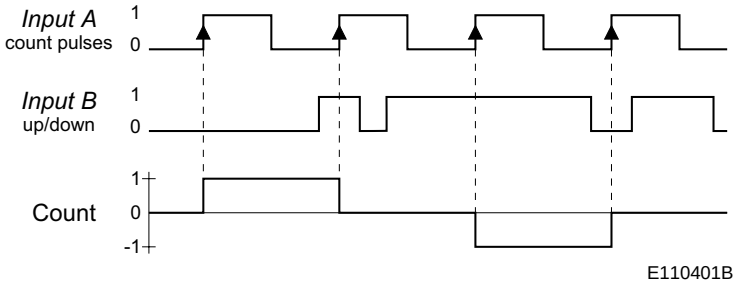
3.2.2 Decimal point

Use the cursor key ⬅ to select one of the 4 possible variants:

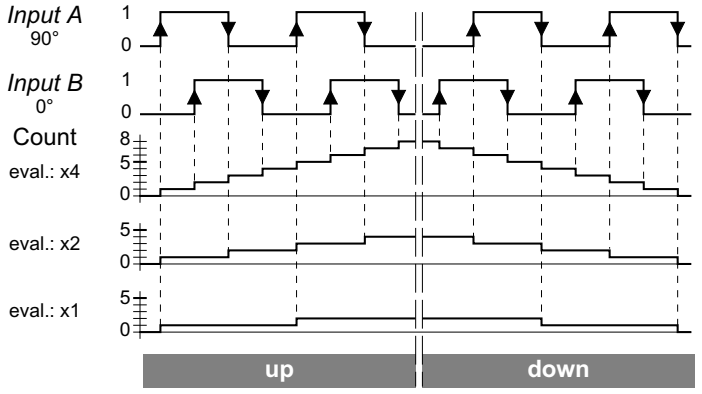
_. = display without decimal point
_._ = display with one decimal
_._ _ = display with two decimals
_._ _ _ = display with three decimals

3.3 System parameters

To enter this operating plane press the store key ➡ and the cursor key ⬆ simultaneously upon switching on the supply voltage. The following parameters and their variants are available (**standard** settings are printed in **boldface**):

Parameter	Variant	Description
1. Count inputs A, B		
In	***dIF***	A, B as differential inputs: A accumulative, B subtractive 
	ud	A is the count input, B is the counting direction input (up/down) 

		phase discriminator mode with edge evaluation
	Ph1	once,
	Ph2	twice,
	Ph4	quadruple



2. Input frequency

Fr		input damping
	0.03	30 Hz (bounce-proof),
	40	40 kHz

3. Mode

F4		count = P2 ⇒
	0	no automatic reset
	1	automatic reset

4. Switching duration of output *Out 1*

F5	*oFF*	no output signal
	bI	bistable output signal
	0.02	20 ms
	0.05	50 ms
	0.10	100 ms
	0.50	500 ms
	1.00	1 s

5. Switching duration of output *Out 2*

F6	same as *F5*

6. Reset-signal

F13		signal processing
	0	static,
	1	dynamic

7. Function of preselection 1 (P1)

F20		value is effective
	0	absolute (count = P1 → *Out 1*),
	1	in relation to preselection 2 (presignal for preselection 2, count of counter = P2 + P1 → *Out 1*)

8. Output signal memory

F21	***0***	outputs reset after having switched on the power supply
	1	same switching status as prior to switching on the power supply, monostable times, however, being started anew

9. Input signal level

F24	*0*	npn: active level: Low
	1	pnp: active level: High

10. Lock keyboard reset

F26	***0***	if the signal *Keylock* is active, the keyboard reset is not locked,
	1	locked

11. Programming lock for the set value

F27	***0***	if the *Keylock* signal is active, the key combination is ➡ + F1 unlocked,
	1	locked

12. Programming lock for display parameters

F28	***0***	if the *Keylock* signal is active, the key combination is ➡ + F2 not locked,
	1	locked

13. Programming lock for preselection

F29		if the *Keylock* signal is active, the key(s)
	0	F1 and F2 are not locked
	1	F1 is locked (preselection P1)
	2	F2 is locked (preselection P2)
	3	F1 and F2 are locked (both preselections)

14. Standard settings

F30	***0***	no function
	1	all parameters are set to standard (upon pressing the store key)

Use the cursor key ⬆ to select the requested option and confirm by pressing the ➡ key; thus the subsequent parameter will be automatically activated.

To return to the counting mode

- press the store key ➡ longer than 2 seconds or
- this is performed automatically approx. 40 seconds after having last actuated any key (modified parameters will not be saved).

4 Control signals

4.1 Count inputs *Input A* and *Input B*

The count inputs (terminals 30 and 29) are controlled with the positive or negative signal edge (pnp / npn, see system parameter F24). The maximum counter frequency is 40 kHz.

You may use all commercial electronic pulse generators, whose High level is > 8 V.

Signals emitted by mechanical, potential-free switches are processed (bounce-free, max. 30 Hz).

Use the first system parameter ‘In’ to determine the function of the counting inputs, i.e. the counting mode (see para. 3.3, 1st point).

4.2 *Reset*

If a reset is carried out the count of the counter will be set to the programmed value (standard: 0) and outputs *Out 1* and *Out 2* will be reset. The following options are available:

a) keyboard reset
   By simultaneously pressing the delete key ⫽ and the cursor key ⬆
   (can be locked by means of the *Keylock* signal, provided that the system parameter F26 had been programmed accordingly)

b) terminal reset
   At terminal 26 High or Low level will be applied (the active level is fixed via system parameter F24 and its processing – either static or dynamic – via F13)

c) automatic reset
   The count of the counter reaches the preselection value P2 (provided that the system parameter F4 had been programmed accordingly)

d) programming reset
   is effected when leaving the 2nd programming plane where the display parameters can be changed.

4.3 Count gate *Inhibit*

As long as High (or Low) level is applied to the control input *Inhibit* (terminal 25), both counting inputs are locked (to determine the active level use system

parameter F24). Thus you can interrupt the counting mode, although the counting pulses continue.

4.4 Display *Hold*

As long as High (or Low) level is applied to the control input *Hold* (terminal 27), the current count of the counter is 'frozen' without loosing any pulse (the active level is fixed by system parameter F24); when changing the level the current count will be shown again. Thus, especially where rapid counting operations are concerned, the counter can comfortabely be read at any time without having to interrupt the current counting operation.

4.5 *Keylock*

As long as High (or Low) level is applied to the control input *Keylock* (terminal 28) (use system parameter F24 to determine the level), certain programming planes cannot be activated and/or a keyboard reset cannot be carried out. (depending on system parameters F26 … F29).

4.6 Outputs *Out 1, Out 2*

The outputs *Out 1* and *Out 2* are available as transistor outputs (pnp) and as potential-free change-over contacts. To protect the counter against harmful voltage spikes we recommend external measures for spark prevention.

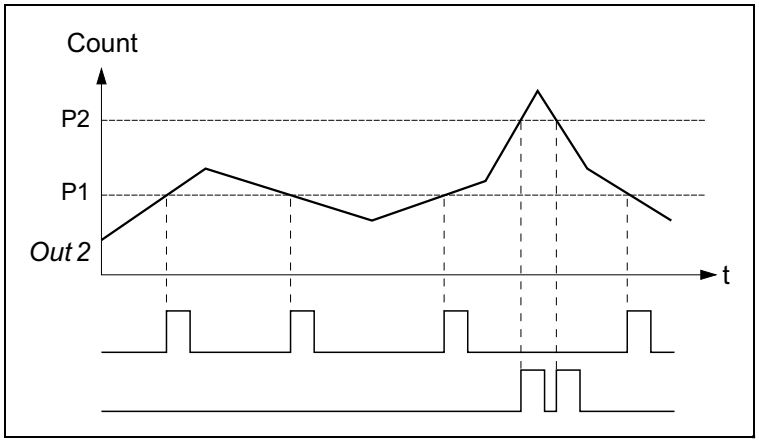
Some fundamental characteristics are:

- The outputs can be locked individually or can be switched to monostable or bistable operation; for this purpose use system parameters F5 and F6.
- The switching status prevailing prior to switching off the voltage supply may be reactivated upon switching on, provided that system parameter F21 had been programmed accordingly; monostable times will be started anew.
- As soon as the count has reached the preselection P2, *Out 1* will be reset; the same also applies to the count provided that system parameter F4 has been programmed accordingly (automatic reset).
- If a reset is performed *Out 1* and *Out 2* will be reset.

Examples:

1. Monostable outputs

a) without automatic reset



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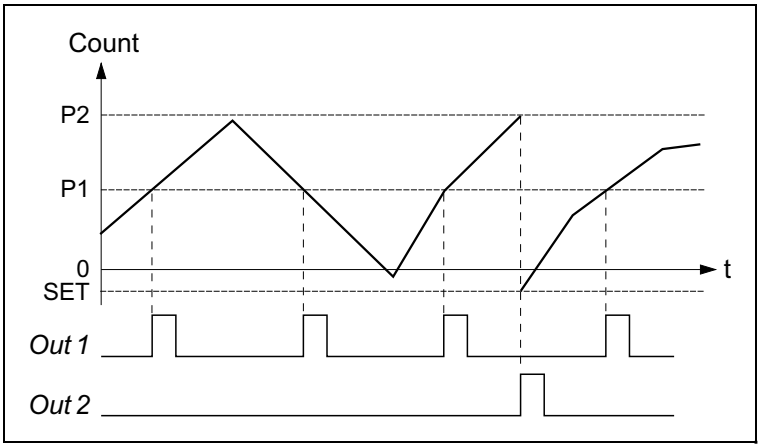
b) with automatic reset (negative set value)



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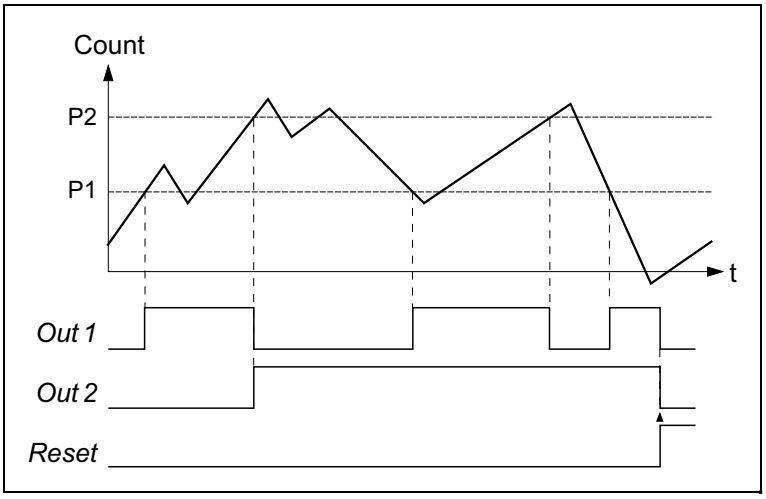
2. Bistable outputs



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5 Assembly, commissioning, diagnosis of errors

5.1 Assembly instructions

1. Before incorporating the counter into the control panel the installation frame (see dimensioned drawing in chapter 6) must be pulled off the counter housing. For this purpose slightly lift the 4 catch brackets (alternately on top and at the bottom, and pushing them forward catch by catch).
2. Turn back the screws of the installation frame by approx. 5 mm.
3. Insert counter into the cut-out of panel and snap installation frame into place.
4. Fix the counter with the screws against the panel (free from play).

5.2 Commissioning

Before setting the counter into operation check whether you can answer the following questions with **yes**:

✔ Does the supply voltage rating correspond to the voltage specified at the counter?

✔ Has the supply voltage been connected to the correct terminals and is the polarity correct for DC supply?

✔ The maximum counter frequency will not be exceeded?

✔ Have the control pulses for the counter got the necessary switching thresholds (see para. 6.2)?

✔ Has programming been performed properly, i.e. according to the specific requirements?

5.3 Diagnosis of errors

Problem	Possible cause
no display	• supply voltage OFF or improperly connected
all display segments are ON	• short-time: self-test after having switched on the supply voltage • sporadic: contact of supply voltage connections not in perfect condition or voltage fluctuates under the minimum value
keyboard reset not possible	• locked (system parameter F26) and signal *Keylock* active
input of preselection or other programming not possible	• programming lock(s) switched on (system parameter F27 … F29) and signal *Keylock* active
counter does not count	• counting input not connected properly or bridged • earth connection counter – pulse generator defective • incorrect level (npn/pnp, system param. F24) • contact/pulse generator does not switch properly • max. counting frequency is exceeded • input *Reset*, *Hold* or *Inhibit* activated • pulse or pause width too small • prescaler too small
counter does not count correctly	• bounce/disturbing pulses, vibrations at the encoder • incorrect prescaler
outputs without function	• signal duration programmed "off" (system parameter F5 or F6) • faulty relay • contacts welded because of overload
Error0 message	• programming of prescaler < 0.0005 confirm error message with the store key
Error1 message	• counted value limits exceeded (< -99 999, > 999 999) use keyboard reset to delete error message

6 Technical specification

6.1 Mechanical data

dimensions (W × H × D)	96 × 48 × 108 mm (acc. to DIN 43 700)
fastening	in the panel cut-out 92 × 45 mm with clamping frame, screws M3
control panel thickness	max. 11 mm
electrical connection	2 plug-in-type connecting terminals, 10 and 8 poles, 5 mm grid
lead cross section	1…1,5 mm^2 with end splices
screws	M2.6
weight	DC version: approx. 200 g AC version: approx. 420 g
display	7-segment-LED with leading zero elimination and programmable decimal point
colour	red
digits	6
digit height	14 mm
indicator LEDs	4
data storage	non-volatile memory
data conservation	> 10 years
read cycles	unlimited
write cycles	> 100 000

6.2 Electrical data

Voltage supply

a) DC **U_b**	12…24 V= -5% / +10%
overload protection	external fuse: 12 V= : 0.25 A fast-blow / 0.25 A slow-blow (IEC 127 / UL 198) 24 V= : 0.16 A slow-blow / 0.20 A slow-blow (IEC 127 / UL 198)

peak current consumption	max. 300 mA (incl. 60 mA encoder current)
power consumption	max. 4.5 W (worst case)
b) AC	115 / 230 VAC -10% / +6%, 50…60 Hz
overload protection	external fuse: 115 VAC : 63 mA slow-blow 230 VAC : 32 mA slow-blow
current consumption	typ. 50 / 25 mA (incl. encoder supply)
circuit interruption	1 half-wave acc. to IEC 127-2
counting and control inputs	
switch level	Low: ≤ 2 V; High: ≥ 8 V
amplitude	max. ±40 V
switch edge	pnp / npn (programmable)
pulse shape	any
input resistance	approx. 5 kΩ
count gate *Inhibit* (term. 25)	static
min. pulse duration	12 µs (damped 17 ms)
Reset (terminal 26)	static or dynamic (programmable)
min. pulse width	2 ms (damped 17 ms)
display *Hold* (terminal 27)	static
min. pulse width	3 ms
Keylock (terminal 28)	static
min. pulse width	3 ms
count inputs *Input A, Input B* (terminals 29 and 30)	
frequency	max. 40 kHz (in case of square wave 1:1 with amplitude > 10 V and phase error of max. ±20°); max. 30 Hz (bounce-proof)
pulse width	min. 12,5 µs (damped min. 17 ms)

Outputs

encoder supply (terminals 31, 32)	DC type: U_b - 2 V AC type: 12…24 VDC
max. current	60 mA
relay *Out 1*, *Out 2*	change-over contact
contact protection	none; recommended to be provided externally in case of capacitive and inductive loads
switching voltage	5 VAC/DC … 30 VDC / 250 VAC
switching current	10 mA … 1 A
transistor *Out 1*, *Out 2*	pnp
switching voltage	DC version: U_b - 2 V; AC version: 24 VDC
switching current	max. 10 mA
operate lag	max. 10 ms

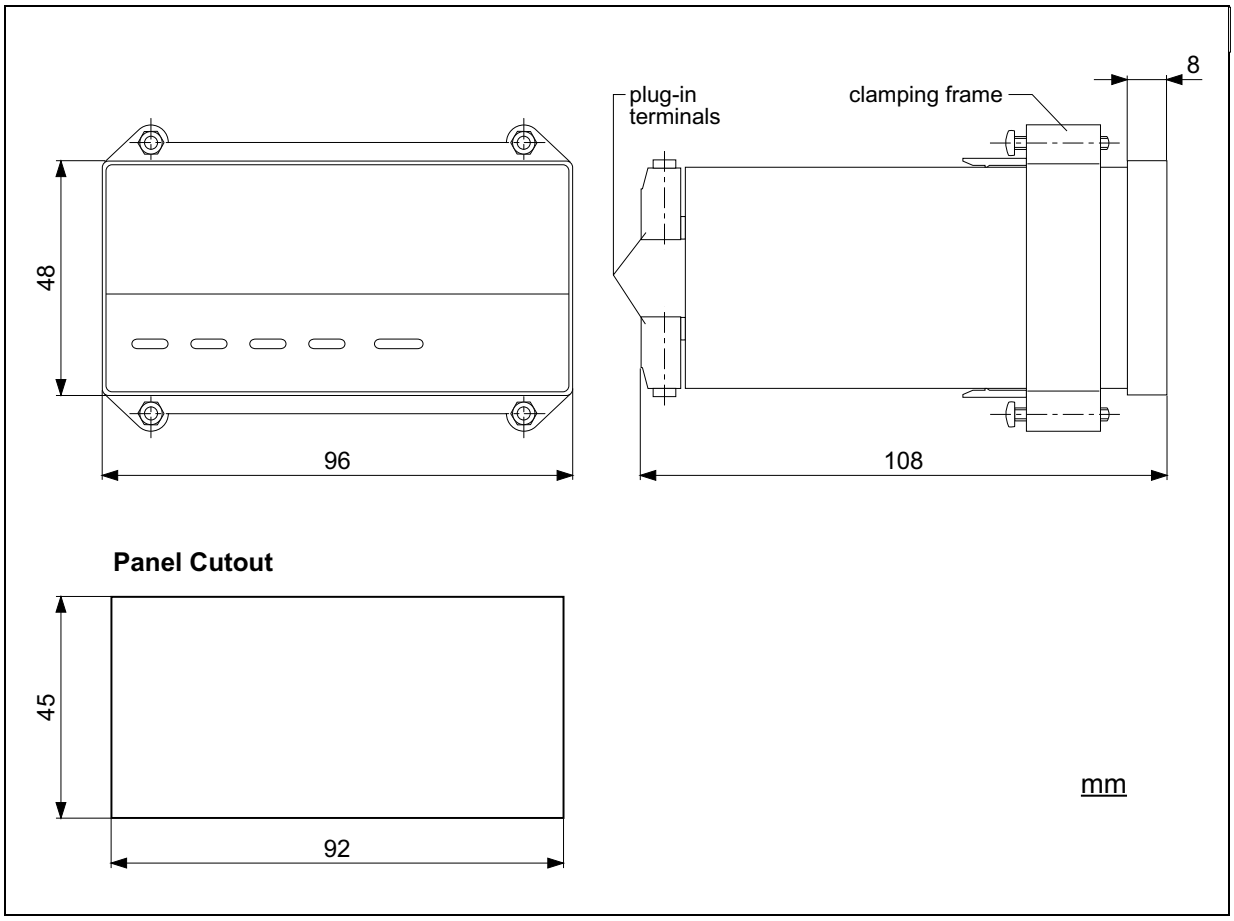
6.3 Environmental conditions

operating temperature	0 °C … + 50 °C
storing temperature	-20 °C … + 70 °C
protection class (IEC 144)	front: IP54 connecting side: IP20
electromagnetic immunity (EMC, IEC 801, P2 + P4)	DC version: severity 3 AC version: severity 2
resistance to vibrations	10 m/s^2 (10…150 Hz) acc. to IEC 68, P2-4
resistance to thermal shocks	100 m/s^2 (18 ms) acc. to IEC 68, P2-27
design according to	DIN 57411 / VDE 0411, protection class II
ambient conds. (DIN 40 040)	40°C / 92% relative humidity of air
contamination level	2 acc. to VDE 0110

6.4 Type code

GEL 104.**1**	DC operating voltage 12 ... 24 VDC
GEL 104.**2**	AC operating voltage 115 / 230 VAC

6.5 Dimensions



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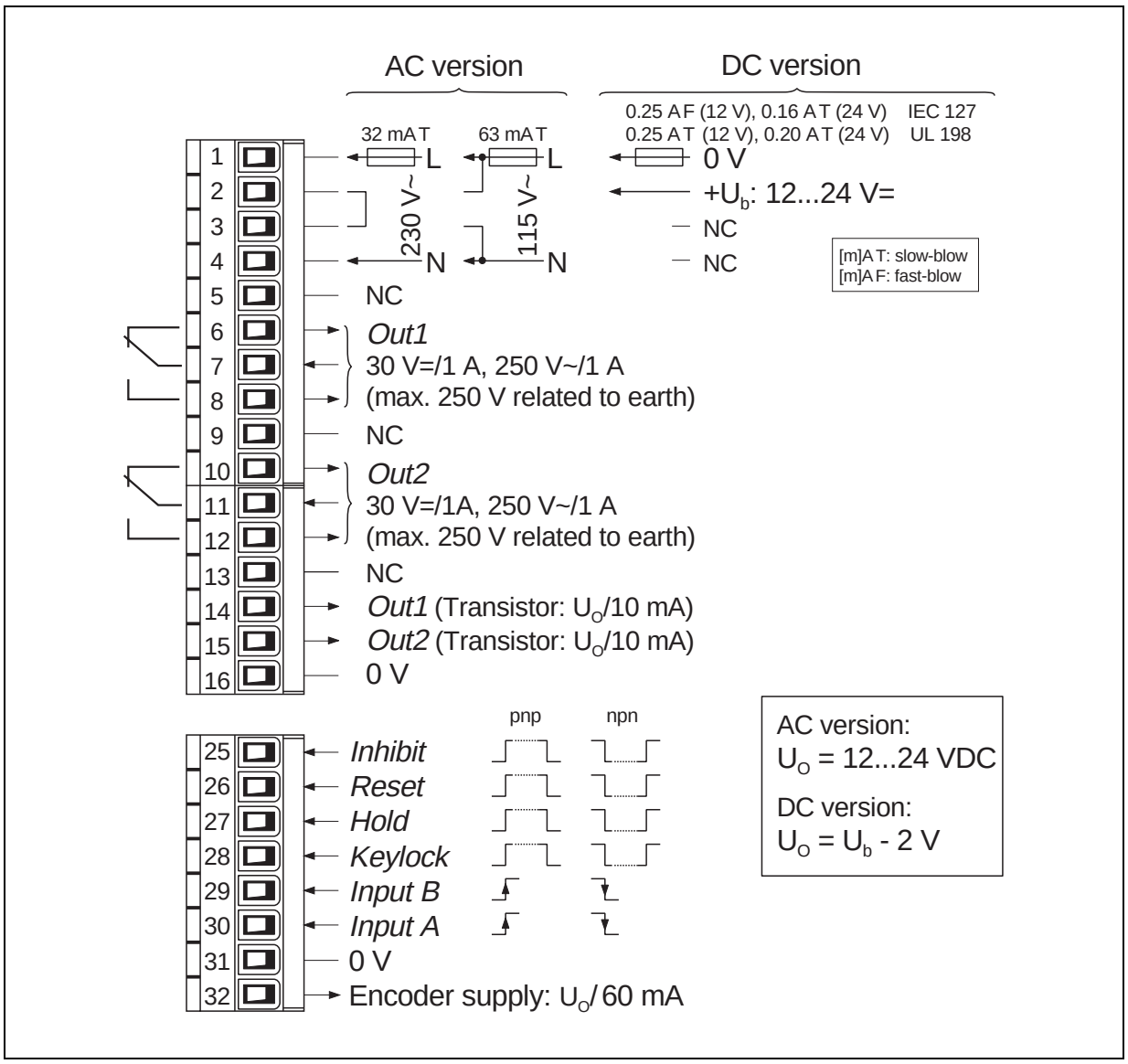
7 Pin layout



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Note: The DC type has **no galvanic isolation** between the voltage supply and the electronic inputs and outputs!